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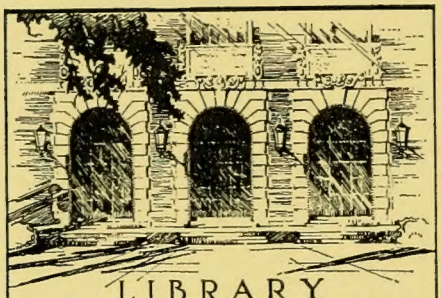
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THE WATERFOWL RESEARCH PROGRAM IN ILLINOIS

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THE WATERFOWL RESEARCH PROGRAM IN ILLINOIS

Arthur S. Hawkins, Frank C. Bellrose, Jr.,
and Harry G. Anderson*

Through Illinois passes one of the heaviest flights of waterfowl found in inland North America. Capitalizing on this fact, thousands of hunters each fall spend many enjoyable hours at the 500 or more duck hunting clubs and at the public shooting areas within the state. The outlay of cash spent in pursuit of the sport of duck hunting runs into a million or more dollars each year.

Within the past decade a shortage of ducks and alterations in their environment have endangered the sport of hunting in Illinois and elsewhere. Regulations governing the take of waterfowl were necessarily tightened to conserve the fast diminishing breeding stock. These restrictions paid dividends; ducks are again increasing in number.

In accord with a nation-wide effort to prevent the reoccurrence of the near-calamity to ducks and to the sport of duck hunting, the Illinois Natural History Survey in February, 1938, undertook a waterfowl survey, in an effort to assemble facts pertinent to the management of the waterfowl resource in Illinois. This report outlines the progress of the survey, which to this time has included principally the valley of the Illinois River, referred to in this report as the Illinois Valley.

1938 ACTIVITIES AND FINDINGS

The 1938 program included experimental plantings of aquatic vegetation, wood duck nesting studies, cover mapping and a survey of the duck hunting season.

Experimental Plantings

A dozen kinds of aquatic plants, rare or absent from the Illinois Valley but highly rated as duck foods elsewhere, were tried in experimental plots. The result was similar to that obtained by many hunting clubs where these plants have been tried in the past--an unfavorable water level killed the plants.

Wood Duck Studies

Preliminary information was gathered on the nesting of the wood duck, the only duck which nests abundantly in Illinois. Further nesting studies were pursued in 1939; a progress report covering both years is in preparation.

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Hunters' mistakes in 1938 accounted for the illegal killing of hundreds of wood ducks. The wood duck is "beautiful but dumb" and falls an easy victim to the aim of novices who are unable to identify one species from another. All increases in wood ducks resulting from improvement in the nesting habitat in 1938 are believed to have been canceled by careless hunters.

Mechanically harvested grain fields were found to be an important source of food. Up to 8,000 wood ducks have been observed in a single evening feeding in the grainfields in one drainage district near Havana.

Duck Food Survey in the Illinois Valley

The vegetation in all the important bottom-land lakes was mapped to scale, to determine the relative abundance of various food and non-food plants. These maps will serve as a basis for comparison with conditions in future years. A comparison between the 1938 and 1939 findings is given later in this report.

Survey of the 1938 Hunting Season

A preliminary report of the survey of the 1938 duck hunting season in the Illinois Valley was presented before the Fourth North American Wildlife Conference,* held in Detroit in February, 1939. Much additional information is now available, largely through the cooperation of the State Department of Conservation in giving free access to reports from duck clubs. A revision of parts of the preliminary report, which was based on less information than is now available, is presented in the following summary.

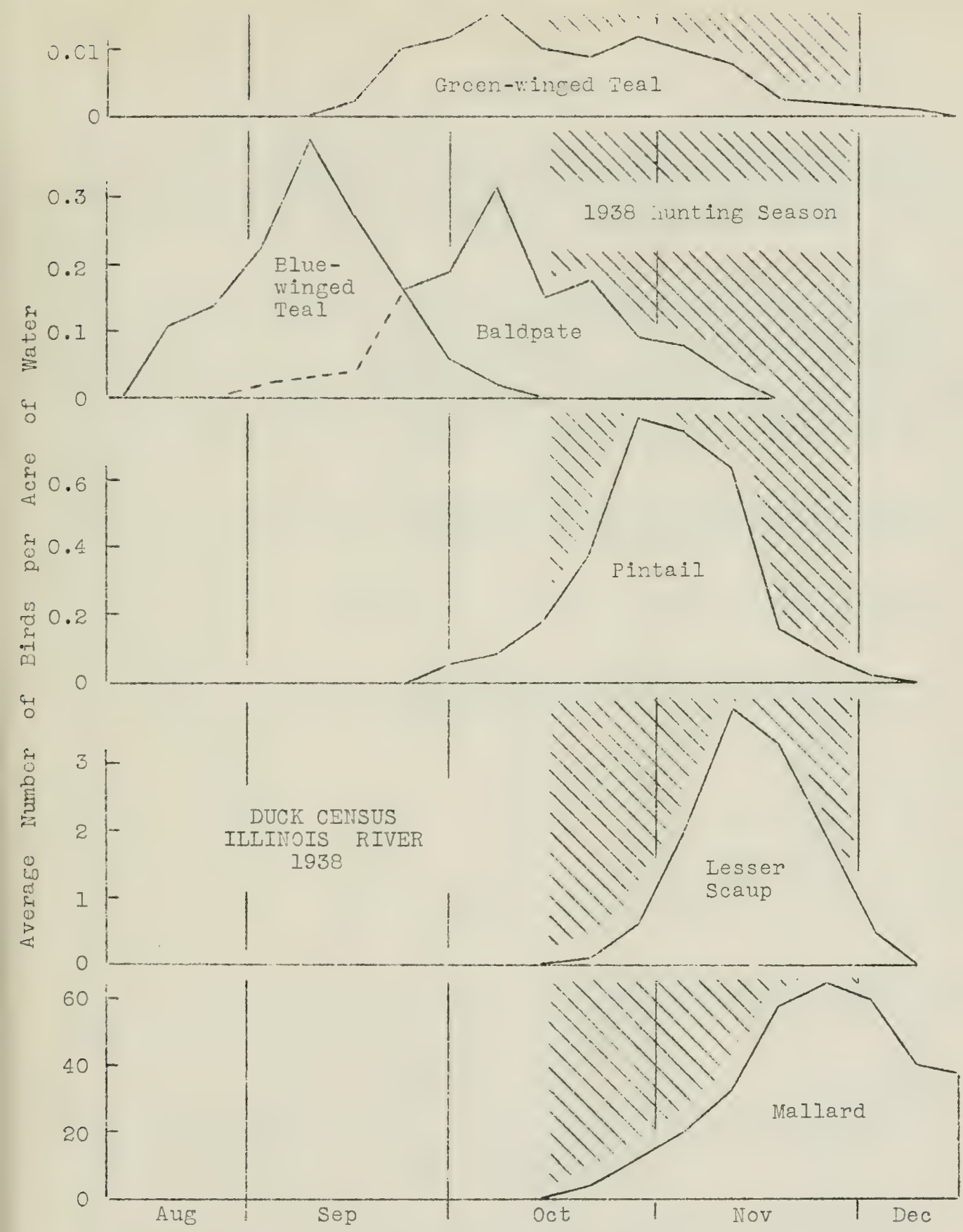
1. Estimated total kill, including cripples lost: 85,000.

2. The kill by species of 250 clubs is given in table 1.

Table 1.--Duck kill of 250 clubs, Illinois Valley, 1938.

Dabbling Ducks	Number	Diving Ducks	Number
Mallard	32,047	Lesser scaup (bluebill)	2,537
Pintail	7,570	Ring-necked (blackjack)	414
Green-winged teal	5,652	Canvasback	240
Gadwall	3,082	Redhead	130
Baldpate	2,568	Bufflehead	129
Blue-winged teal	2,025	Ruddy	70
Shoveler	1,437	Golden-eye	7
Black duck	881	Miscellaneous	3
Total	55,262	Total	3,530

*This report was published in the July-August issue of American Wildlife. Reprints can be obtained by writing to the Illinois Natural History Survey, Urbana, Illinois.



The duck populations represented in the above polygons were measured as follows: the ducks were counted on numerous lakes throughout the concentration area. The acreage of each lake censused was then measured on large scale maps with a planimeter. The points on the polygons show the number of ducks per acre of water during weekly periods. A moving average of three weeks was used to smooth the curve.

3. Crippling losses (based on 1,009 man-day reports): 1,819 cripples were lost while 4,960 ducks were being bagged, an average of 3.7 cripples per limit of 10 ducks. This average includes both diving and dabbling ducks. About five divers were lost per limit, as compared to half that many dabblers.

4. The 1938 flight: The flight of 1938 was heavier and later than that of 1937, according to reports. We estimate that at least 3 million ducks passed through the Illinois Valley in 1938. Nearly a half million ducks were seen at one time during the peak of the flight on the Chautauqua Lake Migratory Waterfowl Refuge, near Havana. The average number of ducks per acre of Illinois River bottom-land lake during the fall flight was about 45. Somewhere in the neighborhood of 1 out of 40 ducks which entered the valley is believed to have been eliminated by hunters.

5. The 1938 flight by species: The ratio (per cent) of mallards to all other species combined, present at various periods during the fall is given in table 2.

Table 2.--Ratio of mallards to all other ducks, Illinois Valley, 1938.

Mallards	All Other Ducks	Period
2	98	Oct. 1-7
24	76	15-22*
80	20	23-30*
85	15	Nov. 1-15*
99	1	16-28*
98	2	Dec. 1-15

*1938 hunting season (45 days)

The relation of the peak and magnitude of the flight, in various species, to the dates of the 1938 hunting season is represented by the diagram on the preceding page.

6. Kill per hunter per day: Perhaps the best comparison of hunting conditions at various clubs and in various parts of the state is the average number of ducks bagged per hunter per day's shoot. On this basis the highest possible score within the law is 10 ducks per hunter per day; the lowest score is of course 0.

The duck kill in the counties along the Illinois River is shown in table 3. For some counties the figures are more nearly accurate than for others because they are based on larger samples.

Table 3.-- Total bag and average man-day kill by clubs in the counties bordering the Illinois River, 1938.

County	Club Reports Received	Reported Killed	Clubs Reporting Man-Days*	Man-Days Reported	Ducks in Man-Day Reports	Average Man-Day Kill
Upper River						
Grundy	7	1,035	5	183	718	3.92
La Salle	20	3,241	12	394	1,822	4.62
Bureau	19	7,240	14	999	5,803	5.81
Putnam	19	5,103	10	419	1,974	4.17
Marshall	32	5,543	24	778	3,892	5.00
Peoria	13	5,508	8	317	1,905	6.01
Woodford	8	1,154	5	108	262	2.42
Middle River						
Tazewell	6	835	3	108	632	5.85
Fulton	13	8,468	10	789	4,900	6.21
Mason	45	11,192	31	792	5,231	6.61
Schuyler	9	1,893	6	179	844	4.71
Cass	33	4,800	19	321	1,985	6.15
Lower River						
Brown	1	49	1	13	49	3.78
Morgan	9	1,749	9	305	1,741	5.71
Scott	2	958	2	148	958	6.47
Pike	6	648	6	161	648	4.02
Jersey	1	121	1	29	121	4.48
Calhoun	8	565	6	132	515	3.83
Total	251	60,102	172	6,175	34,000	4.99

*Not all clubs reported the number of man-days of hunting at their grounds; hence, the average man-day kill per county is based on only those clubs which kept this information.

7. Comparison of Illinois River counties: The number of clubs in several categories based on number of ducks killed per club is given in table 4.

Table 4.--Classification of duck clubs in the Illinois Valley, based on the reported duck kill, 1938.

County	Total Clubs Reporting	Number of Ducks Killed					
		-150	150-250	250-350	350-500	500-1000	1000+
Upper River							
Grundy	7	4	2	1	-	-	-
La Salle	20	17	1	-	-	-	2
Bureau	19	9	4	1	3	1	1
Putnam	19	11	2	3	1	-	2
Marshall	33	22	3	3	1	2	2
Peoria	13	8	-	-	2	1	2
Woodford	8	5	2	-	-	-	-
Middle River							
Tazewell	6	4	1	-	-	1	-
Fulton	13	6	-	-	-	5	2
Mason	46	29	6	2	1	4	4
Schuyler	9	5	1	2	-	1	-
Cass	33	24	5	2	1	-	1
Lower River							
Brown	1	1	-	-	-	-	-
Morgan	9	6	-	1	-	2	-
Scott	2	1	-	-	1	-	-
Pike	6	3	3	-	-	-	-
Jersey	1	1	-	-	-	-	-
Calhoun	8	7	1	-	-	-	-
Total	253	163	31	15	10	18	16

8. Sex ratios: A normal sex ratio is one in which the number of males and females is approximately equal. Species which are monogamous must have a normal sex ratio if they are to produce offspring with greatest efficiency. Wild ducks are believed to be monogamous. The sex ratio in most species of ducks is known to be more or less unbalanced in favor of the male. While the effects of an abnormal sex ratio are unknown, it is logical to assume that such a condition is unhealthful to the species.

To manage waterfowl successfully, we must learn (1) the sex ratio in the various waterfowl species and (2), if this ratio is abnormal, how the condition can be corrected.

Our 1938 findings in one species, the mallard, are given in table 5.

Table 5.--Sex ratio in mallards, Illinois Valley, 1938.

Period	Number Inspected		Per Cent
	Drakes	Hens	Drakes
October 15-31	77	82	48
November 1-15	68	69	50
November 16-28	196	118	62
Total	341	269	56

Let us suppose that it is desirable to correct the sex ratio in mallards. It will be noted in table 5 that there was an excess of hens over drakes early in the season and that the opposite was true late in the season. Perhaps a later hunting season would tend to discriminate against males, thereby helping to balance the sex ratio.

9. Weights: The belief has sometimes been expressed that, since the cessation of legal baiting, ducks passing through Illinois are in danger of starvation. We examined over 2,000 ducks in 1938 and found that only ducks with shot wounds showed signs of starvation. Most of the lightweight ducks were found to be late-hatched juveniles. Their lack of weight could not be attributed to scarcity of food; they were merely light-framed individuals. A summary of mallard weights taken in 1938 is given in table 6.

Table 6.--Weights of mallards taken in the Illinois Valley, 1938.

Period	Number Weighed		Average Weights*	
	Drakes	Hens	Drakes	Hens
October 15-31	77	82	43.8	36.8
November 1-15	68	69	41.9	37.2
November 16-28	196	118	42.7	37.7
Total	341	269	42.8	37.2

*Weights in ounces

The fact that the weights of females increased as the season advanced whereas those of the males behaved erratically seems to be further evidence that the male migration is more or less independent of that of the female.

10. Age groups: The goal of game management is the ethical harvesting of the surplus. A surplus in that part of a population in excess of a breeding stock large enough to maintain the species at some desired population level. In waterfowl at the present time, there is no surplus, because the desired population level is not in sight. We are, therefore, harvesting a portion of the capital stock. Although this is not good management, under the circumstances, it is the best thing to do. It means, however, that unusual vigilance must be directed toward the status of the capital stock, to guard against sharp deflation.

Since increases or decreases in the duck population are primarily the result of successes or failures in breeding, it seems logical that actual measures--not guesswork--are necessary in determining the number of young ducks raised. Two methods of measuring the number of young birds in relation to the number of old birds seem to hold the best possibilities: (1) inspection of the kill of hunters (2) banding. Both methods are limited in application because of a dearth of definite and usable criteria in some species for separating birds of the year from their parents. Work is now in progress to remove this obstacle.

1939 ACTIVITIES AND FINDINGS

In addition to wood duck nesting studies (to be reported in another paper) the 1939 waterfowl program of the Illinois Natural History Survey has given major consideration, up to September 20, to a duck food survey of the Illinois Valley. This is a continuation of studies started in 1938.

Aquatic Vegetation Mapping

During both 1938 and 1939 maps have been made to scale showing the aquatic plants found in the bottom-land lakes of the Illinois Valley. These maps indicate the water depth and turbidity when the survey was made. A follow-up of the mapping is the collection during the hunting season of stomachs from ducks shot over the lakes previously mapped. The resulting information gives a picture of what plants are chosen as food by ducks, and what the relative abundance and distribution of these food plants is throughout the valley. Also learned is the area occupied by plants which do not produce duck foods. An accumulation of this information, augmented by special studies, should eventually yield a plan for reducing the area of non-food plants by increasing the area of food plants.

A brief comparison between the conditions found in 1938 and 1939 follows.

In 1938 high water was prevalent throughout the valley until the latter part of July. A drouth then resulted in an abnormally low water stage throughout the remainder of the growing season for plants. The high water until midsummer precluded the growth of such important duck food plants as nut grass (Cyperus), duck millet (Echinochloa), saw grass (Leersia), a number of smartweeds (Polygonum) and pigweed (Acnida) from growing on the mud flats. Likewise, because of the fluctuating water levels and high turbidity, few important aquatic plants upon which ducks feed were able to thrive in the parts of the lakes which did not go dry. The two most abundant plants in the bottom-land lakes of Illinois, American lotus (Nelumbo lutea) and the river bulrush (Scirpus fluviatilis) are relatively unimportant as duck food producers.

Thus, during the hunting season of 1938, there was a scarcity of natural duck foods in most of the lakes, and the water level was so low as to make many lakes veritable mud flats. Such environmental conditions led the ducks to concentrate in areas possessing a bountiful supply of natural food, and to rest in the center of large lakes during the day, procuring their food from cornfields during the evening and morning hours.

A new factor entered the picture in 1939. Two wicket type dams--one at Whitehouse, near Pekin, the other at La Grange, below Beardstown--were placed in operation to compensate for the low water stage brought about by reducing the diversion from Lake Michigan. The Whitehouse dam raised the water in the Illinois River and adjoining lakes from Pekin to Hennepin; the La Grange dam raised the water level as far as Browning and the Sangamon River. Between Pekin and Browning the lowest stage in the recent history of the Illinois River prevailed during August and September of 1939. Former large lakes, such as Clear, Quiver and Crane, became little more than puddles.

In the following paragraphs is given a summary of the water and duck food conditions found at some of the lakes studied during 1938 and 1939.

Starved Rock Pool, Ottawa.--This lake, formed by a dam built several years ago at Starved Rock, has a fairly constant water level throughout the year. Consequently, the vegetation is more luxuriant and better stabilized than in other Illinois bottom-land lakes in which water levels fluctuate greatly. Beds of sago (Potamogeton pectinatus) and long-leaved pondweed (Potamogeton americanus) occur up to depths of 4 feet. There are two areas covered with a scattering growth of wild celery (Vallisneria), one of the few places in the Illinois Valley where it occurs. Coontail (Ceratophyllum), duck potato (Sagittaria) and duckweeds are other abundant species.

Depue and Spring Lake, Depue.--A paucity of duck food plants prevailed in both 1938 and 1939. No change in status of duck food plants and water levels occurred in 1939, because these lakes are too far north of the new Whitehouse Dam to benefit from its effects. Large beds of river bulrush occurred about both lakes. Small patches of marsh smartweed (Polygonum Muhlenbergii) were present but these produced little seed in 1939.

Goose Pond, Putnam.--This lake contained in 1939 very extensive beds of the unimportant duck food plant, river bulrush. Next in abundance was the American lotus, which is reported to have increased in area during 1938. Large beds of duck potato (Sagittaria latifolia) maintained their size against encroachment by river bulrush. Scattered plants of sago pondweed were found in the open water of the lake and in a number of wooded potholes. Stands of giant bur reed (Sparganium eurycarpum) also occurred.

Sawmill Lake, Henry.--The duck food plants, scarce in 1938, showed some improvement in 1939 with the appearance of sago pondweed. A higher water level, due to the new Whitehouse Dam, seems to be the cause. Extensive beds of river bulrush and American lotus occurred in both 1938 and 1939. A slight decrease in lotus was noted in 1939.

Goose Lake, Sparland.--This state public shooting ground had a higher water level, due to the Whitehouse Dam, and better duck food conditions in 1939 than in 1938. Scattered beds of marsh smartweed, an important duck food plant, occurred about the lake in 1939. Parts of the river ridge were covered with luxuriant growths of nodding smartweed (Polygonum lapathifolium), duck millet, saw grass and pigweed.

Douglass Lake Drainage District, Chillicothe.--About two-thirds of this area was covered in 1938 and 1939 by river bulrush. Marsh smartweed, quite abundant in 1938, was reduced in area in 1939. Numerous patches of white water lily (Castalia) and extensive beds of

coontail (Ceratophyllum) occurred both years in Rice Pond and other ponds in the river bulrush marsh. No wild rice (Zizania) was found in 1938; yet in 1939 fair stands appeared around Rice Pond and two other ponds. Sago pondweed was much more common in 1939 than in 1938.

Big Lake and Goose Pond, Tanner.--Big Lake contained extensive American lotus and river bulrush beds. In 1938 marsh smartweed was abundant about the lake, but in 1939 most of the smartweed was replaced by river bulrush. Two small patches of wild rice appeared in 1939.

In 1938, Goose Pond had the largest bed of duck potato in the Illinois Valley. Because of high water during the growing season of 1938 and 1939, resulting in submergence of the plants, this species was largely replaced in 1939 by American lotus and coontail. Patches of white water lily were materially reduced in size in 1939.

Clear Lake, Mason County.--Clear Lake was practically barren of duck food plants during 1939. In the open water, scattered plants of sago and long-leaved pondweed occurred, while along the shore a few beds of spike rush (Eleocharis), river bulrush and duck potato were found. During the summer of 1939 the water of this lake receded to such an extent that most of the lake was a mud flat. These drouth conditions were due to the fact that the pool of the La Grange Dam did not extend far enough upstream, and the flow through the valley was less than in previous years.

On this extensive mud flat such valuable duck food plants as duck millet, nut grass and pigweed appeared in August and September. Only if the water level rises sufficiently to flood this area will the excellent food become available to waterfowl.

Anderson Lake, Astoria.--In this lake, there was very little change in the aquatic plants between 1938 and 1939. Marsh smartweed was the most abundant species, American lotus second and coontail third.

Ingraham and Crane Lakes, Spicarte.--American lotus encroached upon the open water area of both lakes in 1939. In Ingraham Lake, lotus covered about 85 per cent of the area. Sago pondweed and long-leaved pondweed, scarce in Crane Lake in 1938, were almost wanting in 1939.

Cuba Island, Chandlerville.--This area, because of small levee districts holding water, had in 1938 and 1939 an excellent growth of good duck food plants. In both years marsh smartweed was the most abundant of these food species. In 1939 it was somewhat less abundant than in 1938. Saw grass was second in abundance and covered an equal area in both years. American lotus increased slightly in 1939 over 1938.

Treadway Lake, Beardstown.--Little change in the area occupied by various plants occurred between 1938 and 1939. Several large beds of duck potato, which bordered some islands of the lake, were encroached upon slightly by American lotus in 1939. More scattered patches of giant bur reed were found in 1939 than in 1938. Because of the La Grange Dam, the water level was about 8 inches higher in September, 1939, than the year before.

Muscooten Bay, Beardstown.--Small scattered beds of marsh smartweed covered about the same area in both 1938 and 1939. Extensive tracts were covered with American lotus; there was a slight reduction of this species in 1939. Duck potato increased in abundance in 1939, as did giant bur reed. Sago and long-leaved pondweed, fairly common in 1938, were virtually absent in 1939. The water level of Muscooten Bay has been raised about 12 inches by the La Grange Dam.

Banks of the Illinois River.--The banks of the Illinois River have a much better growth of smartweeds, pigweeds, nut grass, teal grass (Eragrostis) and duck millet in 1939 than in 1938.

General Summary of Food Conditions and Water Level.--Contrasting the waterfowl conditions in the Illinois Valley for 1938 and 1939, we find a slight improvement in natural duck foods in 1939 and, because of the two wicket navigation dams, a higher water level in some lakes and a lower level in others.

Stomach Analyses

Stomachs of almost 2,000 ducks were collected during the 1938 hunting season from cooperating duck clubs. Most of these clubs were located on the Illinois River between Pekin and Browning. Stomachs were obtained also from several clubs along the east side of the Mississippi River between Hamilton, Illinois, and Crystal Lake, across the river from Burlington, Iowa. The analyses of 557 stomachs has been completed to date; over 60 per cent of these were from mallards and pintails; the remainder were from 13 other species, mostly from lesser scaup and ring-necked ducks. All the stomachs so far examined have been from ducks killed between November 6 and 27. Between these dates all the native food plants have mature seeds, and the cultivated grains have been harvested.

Mallards.--Although 39 plant species and 13 animal species were identified from the food contents of 285 stomachs, seed from six plants made up nearly 70 per cent of the total volume of food. These plants are listed in table 7, with their comparative ratings.

Table 7.--Plants most often represented in 285 mallard stomachs, Illinois Valley, 1938.

Plant	Volume*	Per Cent**
Corn (Zea indenta)	452.7	40
Saw grass (Leersia oryzoides)	138.6	13
Smartweed (Polygonum Muhlenbergii)	61.6	6
Nut grass (Cyperus esculentus)	42.5	4
Coontail (Ceratophyllum demersum)	31.2	3
Pondweed (Potamogeton americanus)	11.8	1

*Volume expressed in cubic centimeters.
**Based on a total volume of 1,107.5 cubic centimeters of plant food.

Pintail.--Nineteen plant and 11 animal species were identified from 62 pintail stomachs. The five most important of these are listed in table 8 with comparative ratings.

Table 8.--Plants most often represented in 62 pintail stomachs, Illinois Valley, 1938.

Plant	Volume*	Per Cent**
Corn (Zea indenta)	132.8	56
Nut grass (Cyperus esculentus)	20.1	8
Buckbrush (Cephalanthus)	12.9	6
Saw grass (Leersia oryzoides)	7.4	3
Spike rush (Eleocharis)	3.6	2

*Volume in cubic centimeters.
**Based on a total volume of 234.5 cubic centimeters of plant food.

Animal foods were relatively unimportant in mallards and pintails killed during the period November 6-27.

Lesser Scaup (Bluebill).--Nearly 95 per cent of the contents of 82 stomachs of the lesser scaup was animal food, mostly molluscs (Amnicola, Sphaerium, Pisidium). Coontail and duck potato were the chief plant species represented in the stomach contents.

Ring-Necked Duck (Blackjack).--Plant food was somewhat preferred to animal food by this diving duck, as represented by the 41 stomachs examined. Sago and long-leaved pondweed seeds made up the bulk of the contents. Of the animal foods, molluscs and midge larvae composed 90 per cent of the volume.

Summary of Stomach Analysis.--Over 100 plant and animal species have been identified from the duck stomach contents so far examined. Less than a fifth of these foods, however, constitute an important part of the diet. Corn wasted during the harvest is utilized heavily by mallards and pintails which, together, make up the major part of the duck flight through Illinois. So long as agricultural practices bordering the Illinois River remain the same as they are today there is little chance for widespread starvation among ducks during the hunting season, even if the supply of natural food fails. The belief sometimes expressed, that baiting is necessary to prevent duck starvation, does not apply to Illinois conditions.

There is some evidence that ducks resort to cornfield feeding through necessity rather than preference. The stomach contents of the ducks killed where excellent natural food conditions prevailed contained comparatively little corn.

Stomach analyses, as well as field observations, indicate that the thousands of dollars spent in the past by duck clubs in planting wild celery, wild rice, wapito and sago have accomplished little in bettering the natural food conditions of the Illinois Valley. Studies proposed for the future should evolve a planting schedule suited to the exacting requirements of the Illinois River area.